

IN THE CLAIMS:

25. (Currently Amended) A conversational computing system, comprising:

a multi-modal CUI (conversational user interface) manager, operatively connected to a plurality of I/O (input/output) renderers, for receiving input queries and input events across different user interface modalities and generating output messages and output events in connection with an active application in one or more the different user interface modalities;

a conversational kernel for generating multi-modal dialogs in response to the input queries and input events, and for managing context associated with the active application; and

a conversational API (application program interface) for providing an interface between the application and the conversational kernel.

26. (Original) The system of claim 25, further comprising:

a conversational engine API; and

a plurality of conversational engines, wherein the conversational kernel controls and accesses the conversational engines through the conversational engine API to process the input queries and input events and to generate the multi-modal dialog and output events.

27. (Original) The system of claim 25, wherein the conversational kernel provides conversational services and behaviors that are accessible by an application through the conversational API.

28. (Original) The system of claim 27, wherein the conversational services and behaviors comprise one of conversational security, conversational customization, conversational search, conversational selection, conversational help, conversational memorization, conversational summarization, conversational agents, conversational formatting, conversational prioritization, conversational re-direction, conversational categorization, conversational abstraction and object management, conversational navigation, conversational undo, and a combination thereof.

29. (Original) The system of claim 25, wherein the conversational API comprises a library comprising library functions of conversational foundation classes (CFCs) and fundamental dialog components, wherein the CFCs and fundamental dialog components are accessible through the library for constructing conversational objects, wherein the conversational objects are employed for one of performing conversational procedures and building conversational applications.

30. (Original) The system of claim 29, wherein the CFCs can share context and be activated in parallel within an application or across a plurality of applications.

31. (Original) The system of claim 30, wherein the CFCs and fundamental dialog components comprise one of CUI building blocks, conversational platform libraries, dialog modules, dialog scripts, beans, conversational gestures, and a combination thereof.

32. (Original) The system of claim 31, further comprising a conversational browser, wherein the CFCs, dialog components, CUI building blocks, conversational platform libraries, dialog modules, dialog scripts, beans, conversational gestures, and conversational API are loaded into the system through CML (conversational markup language) pages that are processed via the conversational browser.

33. (Original) The system of claim 29, wherein the conversational objects are implemented one of declaratively, imperatively and a combination thereof.

34. (Original) The system of claim 25, wherein the conversational kernel is a platform that executes on top of one of an operating system, a real-time operating system, a virtual machine and a browser.

35. (Original) The system of claim 25, wherein the conversational kernel executes as an operating system service layer.

36. (Original) The system of claim 25, wherein the system executes on one of a personal computer platform, a server platform, an embedded client device platform and a distributed combination of these platforms.

37. (Original) The system of claim 25, further comprising:
a plurality of I/O resources; and
an I/O API for interfacing with the plurality of I/O resources and for registering the plurality of I/O resources with the conversational kernel.

38. (Original) The system of claim 37, wherein the conversational kernel comprises a conversational transcoder for providing adaptation of the behavior, CUI and dialog presented to a user based on capabilities of the I/O resources and conversational engines.

39. (Original) The system of claim 37, wherein the I/O API layer comprises one of I/O abstractions, user interface abstractions, device abstractions and a combination thereof.

40. (Original) The system of claim 26, wherein the conversational engines comprise NLU (natural language understanding) and NLG (natural language generation) engines, and wherein the multi-modal dialogs comprise NLU and NLG dialogs.

41. (Original) The system of claim 40, wherein the conversational kernel provides support at the dialog management level for NL (natural language) and use of context for disambiguation and mixed initiative.

42. (Original) The system of claim 25, wherein the conversational kernel comprises:
a dialog manager for managing dialog across active applications and for selecting an active dialog, context and application based on input queries;
a resource manager for managing and allocating conversational engines that are used during execution of conversational tasks;

a conversational task dispatcher for coordinating and dispatching conversational tasks;
and
a context stack for accumulating a context of an active discourse of a conversational task,
the context comprising query arguments, a list of attribute value – uples and conversational state.

43. (Original) The system of claim 42, wherein the context stack comprises a global history of context.

44. (Original) The system of claim 42, wherein the context stack comprises a meta-information repository.

45. (Original) The system of claim 44, wherein the meta-information repository comprises a-priori known information.

46. (Original) The system of claim 44, further comprising a meta information manager for managing the meta-information repository, wherein the meta-information comprises a plurality of abstract categories associated with elements comprising one of files, directories, objects, data stream handles, networks, peripherals, hardware, applications, networked file systems and a combination thereof.

47. (Original) The system of claim 46, wherein the meta-information is used to provide shortcuts to the elements.

48. (Original) The system of claim 46, wherein a user can navigate the categories of the meta- information through multi-modal conversational dialogs that comprise filling sets of attribute values out of a set of possible query types, and wherein the user can refine or modify the result of current navigation queries based on similarities of the corresponding categories.

49. (Original) The system of claim 46, wherein the meta-information provides a-priori knowledge information for the categories of meta-information.

50. (Original) The system of claim 44, wherein the meta-information comprises user meta- information representing one of user preferences, security, habits, biometrics, behavior and a combination thereof.

51. (Original) The system of claim 50, wherein the user meta-information is one of provided directly by the user, learned from past usage of the system by the user, and a combination thereof.

52. (Original) The system of claim 42, wherein the conversational kernel further comprises a back- end abstraction layer for accessing back-end logic via the dialog manager.

53. (Original) The system of claim 25, further comprising a communication stack that implements conversational protocols for exchanging information with a conversationally aware system, wherein the conversationally aware system comprises one of a remote application, a remote device, a remote conversational computing system, and a combination thereof.

54. (Original) The system of claim 53, wherein the conversational protocols comprise distributed conversational protocols for exchanging information comprising one of conversational state, conversational arguments, context, conversational engine API calls, results, and a combination thereof.

55. (Original) The system of claim 53, wherein information exchanged between applications through the conversational protocols comprises a description of a conversational state of the applications, wherein the information representing a conversational state comprises one of a grammar, a vocabulary, acoustic models, language models, prompts, synthesis details, parsing details, tagging details, information to manage the dialog, and a combination thereof.

56. (Original) The system of claim 53, wherein information exchanged through the conversational protocols comprises a modality-independent description of an interface of a remote control unit, wherein the interface allows the user to remotely control a conversationally aware appliance through the remote control unit.

57. (Original) The system of claim 53, wherein the conversational protocols comprise conversational discovery protocols for automatically discovering the conversationally aware systems, and wherein the information exchanged through the conversational discovery protocols comprises broadcast requests for handshake, exchange of identifiers, exchange of handles for first registration and exchange of handles for first negotiation.

58. (Original) The system of claim 53, wherein the conversational protocols comprise conversational negotiation protocols for exchanging information to negotiate network topology between the system and a conversationally aware system.

59. (Original) The system of claim 53, wherein the conversational protocols comprise conversational registration protocols for exchanging registering information, wherein the registering information comprises one of conversational capabilities, conversational state, context, and a combination thereof.

60. (Withdrawn) A method for providing conversational computing between a user and one of a single application and a plurality of applications, the method comprising the steps of:
engaging in dialog with the user; and
processing the dialog to one of complete a query, disambiguate a query, summarize a query, correct a query, correct a result of an executed task, communicate the result of such execution, determine a target application of an input/output event, and a combination thereof, based on one of past dialog history, context, user preferences, meta information, and a combination thereof.

61. (Withdrawn) The method of claim 60, wherein the step of engaging in dialog comprises engaging in multi-modal dialog.

62. (Withdrawn) The method of claim 60, wherein the step of engaging in dialog comprises engaging in mixed-initiative dialog.

63. (Withdrawn) The method of claim 60, wherein the step of engaging in dialog comprises engaging in natural language dialog.

64. (Withdrawn) The method of claim 60, wherein the step of processing the dialog comprises deriving a user-specified action from the dialog and dispatching the user-specified action.

65. (Withdrawn) The method of claim 60, further comprising the step of adapting the rendering of an application to one of a registered dialog modality, device capability and channel capability.

66. (Withdrawn) The method of claim 60, further comprising the step of maintaining the context of each active task.

67. (Withdrawn) The method of claim 66, wherein the context comprises one of short term history, long term history, and both short-term and long-term history.

68. (Withdrawn) The method of claim 66, wherein the step of maintaining the context comprises maintaining one of query arguments, I/O events, application state, conversational arguments, application events, and a combination thereof, associated with the active task.

69. (Withdrawn) The method of claim 60, further comprising the step of presenting a unified and coordinated user interface across the plurality of applications.

70. (Withdrawn) The method of claim 69, wherein the step of presenting a unified and coordinated user interface across the plurality of applications comprises coordinating a plurality of tasks spawned one of locally and remotely.

71. (Withdrawn) The method of claim 69, wherein the step of presenting a unified and coordinated user interface across the plurality of applications comprises dynamically negotiating a topology among the applications based on their registered information.

72. (Withdrawn) The method of claim 71, wherein the step of dynamically negotiating a topology comprises the step of repeatedly renegotiating the topology among the applications during a dialog session based on currently registered application states and resource requirements and capabilities.

73. (Withdrawn) The method of claim 69, wherein the step of presenting a unified and coordinated user interface across a plurality of applications comprises the steps of:

registering, by each application, information comprising application state, application modes, arguments, context, modalities, engine resources, and a combination thereof; and
managing the dialog across the plurality of applications based on their registered information.

74. (Withdrawn) The method of claim 60, further comprising the steps of arbitrating a response to an input query from each application to determine the target application.

75. (Withdrawn) The method of claim 74, further comprising the steps of one of prompting the user for additional input, checking for user confirmation, clarifying an interpretation of user intent, dispatching a user action that is derived from user input, and a combination thereof, after determining the target application.

76. (Withdrawn) The method of claim 73, wherein the step of managing the dialog comprises the step of coordinating the dialog through one of a master/slave, client/server, and peer-to-peer topology among the applications.

77. (Withdrawn) The method of claim 69, wherein the step of presenting a unified and coordinated user interface across the plurality of applications comprises managing the dialog through one of a centralized and distributed context.

78. (Withdrawn) The method of claim 69, wherein the step of presenting a unified and coordinated user interface across the plurality of applications comprises the step of discovering conversationally aware applications and systems.

79. (Withdrawn) The method of claim 60, further comprising the step of abstracting one of a user query, context, manipulated information, and a combination thereof, based on one of contexts, applications, history, user preferences, biometrics, and a combination thereof.

80. (Withdrawn) The method of claim 60, further comprising the steps of:
associating abstract meta-information with elements, wherein the elements comprises one of objects, files, applications, data stream handles, networks, peripherals, hardware, a local file system, a remote file system, dispatched tasks, links, macros, shortcuts, bookmarks, user preferences, user habits and behavior, biometrics, a-priori knowledge acquired, acquired user knowledge, learned user knowledge, and a combination thereof; and
maintaining the abstract meta information of the elements.

81. (Withdrawn) The method of claim 80, wherein the step of associating abstract meta information comprises one of registering an abstract meta information category of an element, creating a new abstract meta information category of an element, and both.

82. (Withdrawn) The method of claim 80, further comprising the step of searching for a target element using the abstract meta information.

83. (Withdrawn) The method of claim 82, wherein the step of searching comprises searching the categories through multi-modal conversational dialog that comprises filling sets of attribute values out of set of possible types of queries and refining or modifying the result of current search queries based on similarities of the associated categories.

84. (Withdrawn) The method of claim 80, further comprising the step of selecting a desired element using the abstract meta information.

85. (Withdrawn) The method of claim 84, wherein the step of selecting comprises selecting the categories through multi-modal conversational dialog that comprises filling sets of attribute values out of set of possible types of queries and refining or modifying the result of current selection queries based on similarities of the associated categories.

86. (Withdrawn) The method of claim 80, wherein the meta-information comprises security meta- information, further comprising the step of automatically authenticating a user when a query to a restricted element is made, based on the security meta-information associated with the element.

87. (Withdrawn) The method of claim 60, further comprising the steps of coordinating and prioritizing output generation based on one of an active dialog, history, and a combination thereof.

88. (Withdrawn) The method of claim 60, further comprising the step of:
memorizing an event, wherein the event comprises one of a user command, a user preference, an I/O event, and results of an executed task; and
subsequently activating the memorized event at a desired time during the dialog.

89. (Withdrawn) The method of claim 88, wherein the step of activating comprises activating the memorized event for presentation to the user.

90. (Withdrawn) The method of claim 88, wherein the step of activating comprises activating the memorized event to resume a memorized dialog commencing from a state in which it was memorized.

91. (Withdrawn) The method of claim 88, wherein the memorized event is used to undo the effect and context impact of the memorized dialog.

92. (Withdrawn) The method of claim 88, wherein the memorized event is activated prior to dispatching an agent or executing a task.

93. (Withdrawn) The method of claim 88, wherein the step of memorizing comprises storing a current context, at the time of memorization of the event, as meta-information.

94. (Withdrawn) The method of claim 88, further comprising the steps of:
summarizing the memorized event; and
activating the event summarization for presentation of the event summarization to the user.

95. (Withdrawn) The method of claim 94, wherein the step of activating the event summarization is performed by one of a user query and a triggering event specified by an application.

96. (Withdrawn) The method of claim 60, further comprising the step of customizing the dialog based on one of user identity, usage history of the user, user preferences, active applications, context, and a combination

97. (Currently Amended) A conversational virtual machine, comprising:
a kernel adapted to manage dialog and context, conversational engines and resources and communication across one of platforms, applications, devices and a combination thereof, having different user interface modalities, to provide a coordinated, universal conversational user interface (CUI) across the different user interface modalities; and
an API (application program interface) comprising abstractions adapted to access conversational services from the kernel.

98. (Original) The conversational virtual machine of claim 97, wherein the conversational virtual machine comprises a shell that executes on top of one of an operating system, a real-time operating system, a virtual machine, and a conversational browser.

99. (Original) The conversational virtual machine of claim 97, wherein the conversational virtual machine executes as an operating system service layer.

100. (Original) The conversational virtual machine of claim 97, further comprising an engine API comprising abstractions adapted to access a conversational engine.

101. (Original) The conversational virtual machine of claim 97, wherein the API comprises a plurality of conversational foundation classes that are accessible through library functions for building one of conversationally aware applications, dialog components for performing specific reusable dialog tasks, and both.

102. (Original) The conversational virtual machine of claim 101, wherein the conversational foundation classes comprise conversational gestures that characterize a modality-independent dialog.

103. (Currently Amended) The conversational virtual machine of claim 97 ~~77~~, wherein the conversationally aware applications and dialog components are implemented one of declaratively, imperatively, and a combination thereof.

104. (Original) The conversational virtual machine of claim 97, wherein the kernel comprises a task manager adapted to drive a conversational engine and a task, process or thread running on the conversational virtual machine.

105. (Original) The conversational virtual machine of claim 97, wherein the kernel comprises:

a resource manager adapted to manage one of local resources, distributed resources, and both; and
an input/output (I/O) manager adapted to manage multi-modal I/O events.

106. (Original) The conversational virtual machine of claim 97, wherein the kernel comprises:

a dialog manager adapted to manage conversational dialog across registered applications;
and
a context stack for maintaining the context of an active application or task under the control of the dialog manager.

107. (Original) The conversational virtual machine of claim 106, wherein the kernel further comprises an arbitrator for arbitrating a target application of an I/O event between the registered applications.

108. (Original) The conversational virtual machine of claim 106, wherein the API comprises conversational protocols adapted to provide distribution of the conversational virtual machine.

109. (Original) The conversational virtual machine of claim 108, wherein the distribution of the conversational virtual machine comprises distribution of functions and components of the conversational virtual machine across multiple devices or resources that collectively contribute to providing a complete functionality of the conversational virtual machine.

110. (Original) The conversational virtual machine of claim 108, wherein the distribution of the conversational virtual machine comprises distribution of functions of the conversational virtual machine among a plurality of conversational virtual machines.

111. (Original) The conversational virtual machine of claim 110, wherein the role of each of the plurality of conversational virtual machines is dynamically negotiated between the conversational virtual machines.

112. (Original) The conversational virtual machine of claim 108, wherein the distribution of the conversational virtual machine comprises distribution of the dialog manager and context stack across the registered applications.

113. (Original) The conversational virtual machine of claim 108, wherein the conversational protocols comprise conversational distributed protocols adapted to allow coordination of a dialog among a plurality of applications and devices.

114. (Original) The conversational virtual machine of claim 113, wherein the plurality of applications and devices comprise silent partners.

115. (Original) The conversational virtual machine of claim 108, wherein the conversational protocols comprise negotiation protocols adapted to allow the kernel to dynamically negotiate one of a master/slave, a client/server, and a peer-to-peer topology with at least one kernel of a remote conversational virtual machine.

116. (Original) The conversational virtual machine of claim 97, wherein the conversational virtual machine is implemented as program code comprising one of a programming language, scripts and a combination thereof.

117. (Original) The conversational virtual machine of claim 116, wherein the program code comprises instructions for transcribing input events into ASCII input streams and processing the ASCII input streams as objects.

118. (Original) The conversational virtual machine of claim 117, wherein the ASCII input streams comprise a list of attribute-value n-uples.

119. (Original) The conversational virtual machine of claim 116, wherein the program code comprises instructions for comparing dialogs with conversational logic.

120. (Original) The conversational virtual machine of claim 119, wherein the conversational logic comprises logic statements including one of true, false, incomplete, ambiguous, different/equivalent for ASCII comparison, different/equivalent for NLU-converted query comparison, different/equivalent for active query field comparison, unknown, incompatible, incomparable, and a combination thereof.

121. (Original) The conversational virtual machine of claim 97, wherein the conversational virtual machine is implemented as an interface for a UCRC (universal conversational remote control), wherein the UCRC is used to control home appliances that are conversationally aware.

122. (Original) The conversational virtual machine of claim 121, wherein the UCRC comprises a speech-enabled PDA (personal digital assistant) device.

123. (Withdrawn) A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for providing conversational computing between a user and one of a single application and a plurality of applications, the method steps comprising:

engaging in dialog with the user; and

processing the dialog to one of complete a query, disambiguate a query, summarize a query, correct a query, correct a result of an executed task, communicate the result of such execution, determine a target application of an input/output event, and a combination thereof, based on one of past dialog history, context, user preferences, meta information, and a combination thereof.

124. (Withdrawn) A method for performing a transaction or accessing or modifying information through conversational dialog, comprising interacting between a user and an application or multiple applications through multi-modal dialog, wherein the multi-modal dialog comprises one of GUI (graphic user interface) I/O (input/output), text I/O, speech I/O, DTMF (dual tone multi frequency) input and a combination thereof, and processing the multi-modal dialog based on one of past dialog history, context, user preferences, user meta-information, application meta- information, device meta-information, domain meta-information, and a combination thereof, to determine a target of an I/O event, and to perform one of prompting a user for additional input, checking for user confirmation, clarifying an interpretation of user intent, dispatching a user specified action that is derived from a user input, and a combination thereof.